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BACKOMYIA (DIPTERA-ASILIDAE), A NEW GENUS

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AND
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The genus *Backomyia* is proposed for four species of small robber flies which were at first included in a revision of *Nannocyrtopogon* Wilcox and Martin.[1] Further study, however, revealed a closer relationship to *Metapogon* Coquillett, *Eucyrtopogon* Curran, and *Wilcoxia* James. The writers are indebted to A. T. McClay, of the University of California (Davis), for the loan of specimens and to Curtis W. Sabrosky, of the Entomology Research Branch, for checking on availability of generic names. Types are in the Wilcox collection unless indicated otherwise.

Backomyia, new genus

Face nearly flat in profile but slightly convex, in front view at the antennae about one-half width of one eye. Frons flat, vertex but little excavated, ocellar tubercle narrow, about one-third the width of vertex. First two antennal segments subequal in length, both with strong black bristles below, third segment widest basally and tapering apically, two-jointed style at least half the length of third joint. Mesonotum in side view but slightly arched, with well developed lateral and dorsocentral bristles. Hypopleural fringe crinkly. Scutellum flattened, pollinose, with sparse discal hairs and strong marginal bristles. Abdomen with anterior margins and posterior corners of most segments pollinose, 7 segments in male and 8 in female. Middle tibiae with a pair of straight stout spines at apex anteriorly, one of which is usually black, the other brownish. Fore tibiae without twisted apical spine; pulvilli and empodia present and well developed. Knob of halteres red, wings hyaline with brown spots on the crossveins and furcations, third vein branched opposite or before apex of discal cell (discal crossvein), the 5 posterior cells and anal cell open at wing margin. Ovipositor with apical blunt spines; male genitalia small, usually inverted with hypandrium dorsal.

Genotype: *Eucyrtopogon limpidipennis* Wilcox.

Named in honor of Ernest A. Back, whose monograph of the Leptogastrinae and Dasypogoninae[2] published over 40 years ago has been the one great stimulant to the study of these flies in North America and is still the most consulted paper on these groups of robberflies today.

The related genera can be separated by the following key:

1. Middle tibiae at the apex with a comb of about 5 strong slightly curved black spines 2

[1] Annals Ent. Soc. Amer. 29(3):449-459, 1936.
[2] Trans. Amer. Ent. Soc. 35:137-400. 1909. 12 plates.

Middle tibiae at the apex anteriorly with a pair of strong straight spines, one of which is frequently black 3

2. Scutellum bare, with short, strong marginal bristles; dorsocentral bristles usually present; abdomen with posterior corners and anterior margins of most segments pollinose; bare species ..... *Nannocyrtopogon* Wilcox and Martin

Scutellum long pilose, sometimes with a few apical bristles intermixed; dorso-central bristles absent; abdomen never with pollinose markings as above; more pilose species ..... *Cyrtopogon* Loew

3. Scutellum with dense, long, crinkly hairs and with long, slender marginal bristles; face in profile gibbous; densely pilose species ..... *Eucyrtopogon* Curran

Scutellum bare or at most with a few scattered hairs on disc, marginal bristles strong; face in profile flat, or if convex, on lower half or less; less pilose species 4

4. Scuttellum with sparse discal hairs; mystax composed of rather dense, long fine hairs reaching almost to the antennae; face narrow, about one-half the width of one eye at the antennae; third vein branched opposite or before discal crossvein but without a stump vein ..... *Backomyia* new genus

Scutellum bare; mystax sparse, most prominent on the oral margin; face more than half the width of one eye at the antennae 5

5. Wings hyaline or infumated with brown, third vein branching beyond the discal crossvein and without stump vein, second submarginal cell acute basally ..... *Wilcoxia* James

Wings hyaline or brown, with definite brown spots on crossveins and furcations, third vein branched before discal crossvein and with a distinct stump vein, second submarginal cell obtuse basally ..... *Metapogon* Coquillett

The species of *Backomyia* have been taken only in the fall, and there is little difference between the sexes. The white hairs in the mystax of the males are usually replaced by all or nearly all black hairs in the females, and the hairs are less numerous in the females. In *anomalus* new species, the wings of the males are hyaline while there are brown spots on the crossveins and furcations in the female wings.

KEY TO THE SPECIES

MALES

1. Four or five strong black bristles below on first antennal joint; mystax white in middle below, black on sides and above; wings hyaline with faint brown spots on crossveins and furcations; length 6.5-7.5 mm. (New Mexico) ..... *limpidipennis* (Wilcox)

One or two strong black bristles below on first antennal joint 2

2. Mystax entirely white; wings lightly and evenly infuscated; posterior pollinose spots on abdomen extending narrowly forward to anterior margins; length 5-6 mm. (California) ..... *schlingeri* new species

Mystax in part black; posterior abdominal spots not extending forward laterally 3

3. Mystax white with about 8 scattered black hairs in upper part; humeral and hairs on first antennal joint, white; length 6-7 mm. (California) ..... *anomalus* new species

Mystax white in the middle, black on the sides; wings infuscated, darker on the crossveins and furcations; humeral and antennal hairs black; length 6 mm. (California) ..... *hannai* new species

FEMALES

1. Four to five strong black bristles below on first antennal joint; posterior pollinose spots on abdomen not extending forward on lateral margins; wings hyaline with brown spots on crossveins and furcations ..... *limpidipennis*

Two strong black bristles below on first antennal joint 2

2. Sides of abdominal segments pollinose, connecting with anterior fasciae at sides; wings hyaline with brown spots on crossveins and furcations; scutellar hairs white ..... *anomalus*

Posterior spots not extending forward laterally on abdominal segments 3-5 3

3. Wings infuscated, darker on crossveins and furcations; humeral and scutellar hairs white; sides of second abdominal segment usually pollinose ..... *schlingeri*

Wings nearly hyaline, with brown spots on crossveins and furcations; humeral and scutellar hairs black; posterior pollinose spots on second abdominal segment not extending forward laterally ..... *hannai*

Backomyia anomalus new species

MALE. Length 6 mm. Head black, densely gray pollinose, face with a slight golden tinge, slightly less than one-half the width of one eye. Mystax yellowish with about eight brown hairs in upper part; hairs of frons and ocellar tubercle black, latter with four longer ones; occipital hairs and bristles, and beard, white. Antennae black, first two segments about as broad as long; sparse hairs white on first, black on second; first with two and second with one strong black bristle below; third segment one and one-half times the length of first two, slightly tapering apically; style rather thick, of even width, with spine at tip, three-fourths length of third.

Mesonotum black, densely white pollinose; sparse hairs as long as first two antennal joints, largely white anteriorly and black posteriorly. Bristles black, 2 presutural, 1 supraalar, 1-2 postalar and 6 dorsocentral. Pleurae and coxae densely yellowish white pollinose, hairs white. Scutellum densely gray pollinose, at center of disc with small round black spot, a few scattered fine white hairs and 4 black marginal bristles.

Abdomen black, sides of segment 1 and posterior corners of 2-6 and anterior margins of 2-6 not reaching the sides, gray pollinose; anterior fasciae broad and deeply emarginated at middle, almost completely divided on 2 and 6. Sparse short appressed hairs white, longer on sides of first three segments. Genitalia brownish, yellowish haired.

Legs black; hairs and bristles white; claws black, reddish at base; empodia and pulvilli brownish; hairs long and fine below and posteriorly on fore femora, strong and bristle-like below on fore tibiae.

Knob of halteres red, base and stem brown; alulae brown, margin and fringe yellowish. Wings hyaline, veins brown, anterior crossvein at two-thirds length of the discal cell, third vein branched opposite discal crossvein.

FEMALE. Length 7 mm. Similar to male. Sparse mystax black with a few yellowish hairs on oral margin. Style about two-fifths length of the third antennal joint. Sides of abdominal segments 2 to 6 pollinose and connected with anterior fasciae. Third vein branched well before discal crossvein, crossveins and furcations spotted with brown.

Holotype: Male, White Water, Riverside County, California, Nov. 25, 1947 (J. Wilcox). Allotype: female, same data.

Backomyia hannai new species

MALE. Length 6 mm. Head black, grayish golden pollinose, frons at certain angles appearing brown. Face at the antennae one-half width of one eye. Mystax black laterally and above and white at middle below; frons and ocellar tubercle with black hairs, occipital bristles black with some white hairs intermixed, beard white. First two antennal joints subequal in length; third, one and one-fourth times length of first two together; slender style subequal in length to third joint; first two joints black haired, first with two strong black bristles below and second with one.

Mesonotum black and black haired, brown pollinose, the lateral margins, central stripe, transverse suture and a transverse line behind humeri grayish golden pollinose. Bristles black, 2 presutural, 1 supraalar, 1-3 postalar, and 5 dorsocentral. Pleurae gray pollinose, hairs white. Scutellum grayish golden pollinose with four black marginal bristles and a few black discal hairs.

Abdomen black, white haired, the posterior corners of segments 1-7 and anterior margins of segments 2-7 not reaching lateral margins, golden pollinose. Genitalia shining black, hypandrium white haired, surstyli brown haired.

Legs black, hairs white, bristles brownish black; claws black, brownish basally; pulvilli light brown; empodia brown.

Halteres brown basally, knob wine red. Alulae brown, the margins white. Wings light brown, somewhat darker on crossveins and furcations, membrane crinkly. Veins brown, anterior crossvein at three-fifths the length of discal cell, third vein branching opposite discal crossvein.

FEMALE. Length 6 mm. Similar to male. Mystax black. Mesonotum grayish pollinose with brown lateral spots and gemminate central stripe. Abdomen with posterior-lateral spots on segments 1-7 and anterior crossbands on segments 2-7, those on segment 7 very narrow, gray pollinose.

Holotype: Male, Big Bear Lake, Hanna Flats, San Bernardino County, California, Sept. 18, 1948 (J. Wilcox). Allotype: Female, same data. Paratypes: 32 males and 20 females, same data (Guy F. Toland and Wilcox).

1 male and 2 females, Baldwin Lake, San Bernardino County, California, Sept. 18, 1948 (Wilcox).

Backomyia limpidipennis (Wilcox)

Eucyrtopogon limpidipennis Wilcox, Pan-Pacific Ent. 12:204-205, 1936.

Described from specimens taken in Grant County and at Silver City, New Mexico. Additional specimens from New Mexico as follows: Luna County, Nov. 20 and 21, 1935 (R. T. Kellogg) and Grant County, Nov. 16, 1935, and Nov. 3, 1937 (Kellogg).

Backomyia schlingeri new species

MALE. Length 5 mm. Head black, grayish white pollinose, frons with a golden tinge at middle; face at antennae less than one-half the width of one eye. Mystax, beard, hairs on palpi and proboscis and occipital bristles, white; sparse erect hairs on frons and ocellar tubercle and 4 longer ones on ocellar tubercle, black. Antennae black; first two joints subequal in length, short sparse black haired, first with 2 and second with 1 black bristle below; third joint tapered apically and one and one-third times length of first two together; style three-fourths length of the third joint.

Mesonotum grayish brown pollinose, central and intermediate stripes brown. Hairs anteriorly white, otherwise sparse black; bristles black, 2 presutural, 1 supraalar, 1 postalar and 6 dorsocentral. Plurae grayish pollinose, the mesoplurae golden, hairs white. Scutellum grayish brown pollinose and fine white haired, 4 black marginal bristles.

Abdomen black, sparse white haired, longer on sides of first 3 segments. Sides of segments 1-6 gray pollinose, wider on posterior corners of 2-5; anterior margins of segments 2-6 gray pollinose, constricted at middle on 2-5 and divided at middle on 6. Small genitalia brownish black, and white haired.

Legs black, coxae gray pollinose, hairs and bristles white, becoming yellowish to brownish on tarsi; claws black, reddish at base; pulvilli and empodia yellowish.

Knob of halteres red, stem brown; alulae brown, margins and fine hairs white. Wings light brown, crinkled, veins dark brown, anterior crossvein at five-sevenths length of the discal cell; third vein branched opposite discal crossvein.

FEMALE. Length 6 mm. Similar to male. Mystax entirely black. Pollinose posterior spots and anterior bands faintly connected on abdominal segments 5-6.

Holotype: Male, near Hobart Mills, Nevada County, California, Oct. 11, 1952 (C. L. Schlinger), University of California (Davis). Allotype: Female, same data, University of California (Davis). Paratypes: 15 males and 14 females, same data and (J. C. Hall).

Near *hannai* new species, the males of which have the mystax largely black, the occipital bristles and scutellar hairs black; the style and third antennal joint subequal in length; and the posterior pollinose spots on the abdomen not extending forward on the lateral margins. In the females, the occipital bristles and scutellar hairs are black in *hannai* and white in *schlingeri*.

SOME EFFECTS OF CRACKED GRAIN ON THE REPRODUCTION OF THE SAW-TOOTHED GRAIN BEETLE[1]

H. A. TURNEY[2]

The sawtoothed grain beetle [*Oryzaephilus surinamensis* (L.)] is the insect most often found in stored grain in Arkansas. Frequently control measures are used, perhaps unnecessarily, when no other injurious insect is present. The need for insecticidal treatments for saw-toothed grain beetle control could possibly be reduced by the storage of cleaned, dry whole grain as a management practice along with good sanitation measures.

It is generally accepted that this pest cannot live in whole grain stored under optimum conditions (1). Schwardt (2) observed the effect of moisture content, particle size and oil content on infestations of the saw-toothed grain beetle but did not mention the amount of cracked grain present. In order to have more precise information regarding the influence of cracked grain on saw-toothed grain beetle populations, this laboratory study was conducted during the winter of 1955-56 at the University of Arkansas.

METHOD

Cleaned, whole grain rough rice and yellow corn were used as the host grains in these experiments. The moisture level of the grain was determined and adjusted as needed. After adjustment, 250 grams of the whole grain were placed in wide-mouth quart jars. Enough of the whole grain was replaced by cracked grain to produce mixtures that contained 0, 5, 10, 15, 20, and 100 per cent cracked grain by weight. The cracked grain was obtained by grinding whole grain in a hand sausage mill. Tests with rice at six different levels of moisture, ranging from 10 to 19.50 per cent, were replicated four times for each of the mixtures of cracked grain. A single test using corn with a moisture content of 11.56 per cent was likewise replicated four times for each level of cracked grain (Tables 1, 2).

Fifty saw-toothed grain beetles were taken from stock cultures reared on rolled oats and placed in each quart jar. The age of the beetles was not determined. The sex ratio was determined to be 40 per cent males to 60 per cent females in the stock culture. A sample from the experimental jars showed a ratio of 52 per cent females to 48 per cent males.

Two additional experiments were conducted, one with corn, the other with rice, wherein rice weevils [*Sitophilus oryzae* (L.)] and saw-toothed grain beetles were confined on whole grain in the same jar. Three levels of rice weevil populations, each replicated four times, were 25, 50, and 100 to each 250 gram sample. To these different levels 50 saw-toothed grain beetles were added to each jar (Table 3). The age and sex of the weevils were not determined.

[1] Published with the approval of the Director of the Arkansas Agricultural Experiment Station. Study conducted in partial fulfillment of degree, Master of Science, University of Arkansas. The assistance of Dr. Lloyd O. Warren and Dr. Charles Lincoln is gratefully acknowledged.

[2] Now Assistant Entomologist, Texas Agricultural Extension Service.

TABLE 1. The number of progeny produced by 50 saw-toothed grain beetle adults when confined on rough rice and corn with varying amounts of cracked grain at different moisture levels.
College of Agriculture Headhouse, Fayetteville.

Per cent moisture	Host grain	LSD 5%	Per cent cracked grain in each jar					
			0	5	10	15	20	100
Test ran for two months								
10.00	Rice	109	0	5	69	121	131	650
12.00	Rice	549	0	82	336	748	1216	3086
19.50	Rice	885	16	561	3437	7554	0*	9885
11.56	Corn	549	882	1754	2201	3564	3034	6093
Test ran for three months								
11.40	Rice	29	0	4	54	18	5	0*
14.50	Rice	965	22	1199	1483†	1724	2063	0*
15.50	Rice	1319	497	966	3971	2534	4381	0*

*No tests at these levels.
†Adjusted figure, not used in analysis.

TABLE 2. Percentage of progeny from 50 adult saw-toothed grain beetles alive after confinement on rough rice and corn with varying amounts of cracked grain held at different levels of moisture.
College of Agriculture Headhouse, Fayetteville.

Per cent moisture	Host grain	Per cent cracked grain					
		0	5	10	15	20	100
Test ran for two months							
10.00	Rice	1.5	8.8	23.8	39.5	42.9	84.4
12.00	Rice	0.0	29.7	55.8	76.2	84.4	95.0
19.50	Rice	31.0	2.0	22.8	89.2	0.0*	97.8
11.56	Corn	86.1	92.3	92.3	94.8	90.2	97.4
Test ran for three months							
11.40	Rice	0.0	4.9	20.5	22.9	7.3	0.0*
14.50	Rice	7.6	65.8	61.8	77.2	95.0	0.0*
15.50	Rice	4.3	2.7	8.2	10.5	16.1	0.0*

*No tests at these levels.

TABLE 3. Total reproduction from 200 saw-toothed grain beetle adults confined with different population levels of the rice weevil on corn and rice.
College of Agriculture Headhouse, Fayetteville.

Per cent moisture	Host grain	Number of insects confined in each series					
		A		B		C	
		Rice weevil 100	Sawtoothed grain beetle 200	Rice weevil 200	Sawtoothed grain beetle 200	Rice weevil 400	Sawtoothed grain beetle 200
11.50	Corn	229	1196	331	1893	513	1311
13.00	Rice	878	475	966	669	1121	884

The jars containing the grain and test insects were placed in cardboard boxes and stored for the duration of the tests. The lids on the jars were reversed to avoid forming an air tight seal. The temperature ranged from 76° to 82° F. No attempt was made to control the humidity. At the end of the experiment the grain samples were screened and the adult beetles, less the number originally introduced into the jar, were tabulated. The counting was facilitated by means of an aspirator operated by a vacuum pump. Both dead and live insects were recorded. The LSD was calculated by an analysis of variance.

RESULTS AND DISCUSSION

The number of progeny increased as the amount of cracked grain was increased, even when the moisture level of the grain was held constant. As the moisture level was raised and the amount of cracked grain increased, then reproduction was even greater indicating an interaction between the moisture content and amount of cracked grain on saw-toothed grain beetle reproduction (Table 1). In 100 per cent cracked grain reproduction was noticed even at the lower levels of moisture (Table 1). No reproduction took place on the whole grain rice with the moisture content 12 per cent or less. Very little reproduction was obtained in the jars with whole grain rice at 19.5 per cent moisture content. This was likely due to the development of excessive mold in these jars.

In the experiments with corn, even though the grain was held at a moisture level of 11.56 per cent, a considerable number of progeny were produced (Table 1). There was a light infestation of Angoumois grain moth [*Sitotroga cerealella* (Oliv.)] in the corn which might have favored the development of saw-toothed grain beetle populations.

Confining saw-toothed grain beetle adults on rough rice and corn with rice weevils resulted in increased progeny as the number of rice weevils was increased (Table 3). The progeny produced at the highest ratio of rice weevils to saw-toothed grain beetle numbers was an exception. The decline in saw-toothed grain beetle reproduction in this series on corn may have been due to competition between species.

SUMMARY

Experiments were conducted in an effort to determine what effect the content of cracked grain might have on the reproduction of the saw-toothed grain beetle. Six tests were conducted with rough rice as the host; one test with corn. As the amount of cracked grain was increased the saw-toothed grain beetle populations increased. A greater production of progeny was obtained when both the moisture content and amount of cracked grain was increased. Little or no reproduction was obtained on clean rough rice with the moisture content 12 per cent or below. When saw-toothed grain beetles were confined with rice weevils on whole grain, an increase in progeny was obtained except when the ratio of rice weevils to saw-toothed grain beetles was doubled on corn as a host.

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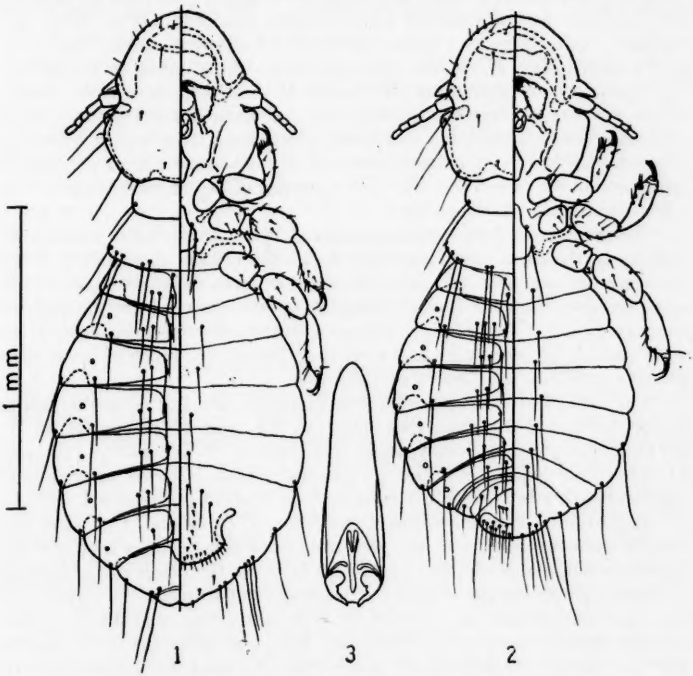
2. Schwardt, H. H. 1934. The saw-toothed grain beetle as a rice mill pest. Arkansas Agr. Expt. Sta. Bul. No. 309. 14 pp.

NOTES ON *LAGOPOECUS SINENSIS* (SUGIMOTO) (Philopteridae, Mallophaga)

K. C. EMERSON
Stillwater, Oklahoma

Lagopoecus sinensis (Sugimoto), 1930, was described from specimens that had been collected from the domestic chicken. The host was from Wenchow, South China. Since the original description, there has been no recorded collection of this parasite. It has been generally considered that the chicken was not the true host. For that reason, the species was not included in a recent review of the Mallophaga occurring on the domestic chicken. Recently, the United States National Museum acquired a collection of Mallophaga which contained a good series of *Lagopoecus sinensis* (Sugimoto). The specimens were collected from the head and neck of domestic chickens in the vicinity of Shanghai, China, in 1939. The size of the series indicates that the chicken is probably the true host. The specimens agree with Sugimoto's photographs, and with his drawings except for his figure 4. In figure



Lagopoecus sinensis (Sugimoto)
1. Dorsal-ventral view of female. 2. Dorsal-ventral view of male. 3. Male genitalia.

4, Sugimoto apparently included the ventral abdominal chaetotaxy with the dorsal chaetotaxy. Illustrations of the specimens are included as figures 1-3. Figures 1 and 2 are drawn to the same scale.

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NOTES ON THE AUTUMNAL EMERGENCE OF THE VERNAL DESERT BEE, *HESPERAPIS FULVIPES* CRAWFORD (Hymenoptera, Apoidea)

PAUL D. HURD, JR.
University of California, Berkeley

In October of 1951, while collecting on the eastern Mohave (Chubbuck and Ludlow, San Bernardino County) and Colorado (Beals Well and Hopkins Well, Riverside County) Deserts of California, several specimens of the melittid bee, *Hesperapis fulvipes* Crawford, including pollen gathering females, were taken from the flowers of the Desert Sunflower, *Geraea canescens* T. & G. Since the normal period of bloom for this plant is April and since the bee, in so far as known, is restricted in its pollen collecting habits to the flowers of *Geraea canescens,* it has become a matter of speculation as to what stimulated this vernal species of bee to emerge in the fall when the *Geraea* was blooming.

The summer of 1951 was characterized by relatively heavy rainfall, especially in the areas mentioned above. Specific rainfall data for these stations are not available; however, rainfall data from adjacent stations indicate that more than one inch of precipitation was recorded during the later summer months. The stands of *Geraea canescens* observed during October were sporadic in occurrence and were to be found over much of the eastern Mohave and Colorado Deserts of California.

A possible and quite plausible explanation in the matter of the timing of the bloom and the emergence of the bee has been offered by Dr. F. W. Went, Department of Botany, California Institute of Technology *(in litt.).* He writes that if the maturation process of the bee is initiated when the soil surrounding the bee cells becomes wetted we would have a perfect mechanism to coordinate the bee and plant development. Additionally he states that since *Geraea canescens* does not germinate until about one inch of rain has been received, and since one inch of rain moistens the desert soil to a depth of from eighteen to twenty-four inches (sufficient to reach the cells of the bee), germination and the onset of the maturation process of the bee would commence at the same time. Thus, Dr. Went concluded that since the bee and the plant would presumably be affected in the same way by temperature, we might have here a mechanism through which the bees would emerge at the same time the plants are ready to flower.

NOTES ON THE BIOLOGY OF A SAWFLY, *NEMATUS SALICIS-ODORATUS* DYAR[1,2]

LLOYD O. WARREN
University of Arkansas

The scented willow sawfly, as it was called by Dyar in his original description, was first noticed in northwest Arkansas during 1950-1951. As far as could be determined, only weeping willow, *Salix babylonica,* was attacked with most infestations appearing on single or isolated trees. Following 1951 no further record of its occurrence in Arkansas has been obtained. Various sizes of trees were infested with partial to complete defoliation occurring, depending on the size of the tree, number of larval colonies present, and increase of numbers in successive generations.

The published information pertaining to this sawfly is largely taxonomic in nature (Muesebeck et al, 1951). The previously known range extended from the northeastern United States to Illinois. During the two years that infestations were observed in northwest Arkansas data on its life and seasonal history were taken.

METHOD

Larval infestations were first noted in late July of 1950. Attempts to conduct rearing studies in 1950 and 1951 were only partially successful. Larval mortality was very high under laboratory conditions and only a few specimens were reared to the adult stage. Oviposition data were obtained by counting the eggs in egg masses deposited on the host tree. Various techniques were used in the laboratory to obtain life cycle data. Confining five to ten newly hatched larvae on fresh willow leaves in a shell vial was the more successful technique. Larvae confined individually did not survive. Fresh food was provided daily. As the larvae approached maturity, about an inch of loose, barely moist soil was placed in the bottom of the vial as a site for pupation. Concurrent observations of larval colonies on infested trees were made to supplement laboratory studies.

RESULTS AND DISCUSSION

SEASONAL HISTORY. Egg deposits and larvae appeared on host trees about mid-May of 1951. Nearly mature larvae were observed by June 6. Eggs from first generation adults were seen soon after with second generation adults emerging July 2 and 3 from laboratory-reared material. Third generation adults appeared in early August, fourth generation in early September with the latest adult emergence, under insectary conditions, occurring on October 13. There were then, in the vicinity of Fayetteville and under the weather conditions prevalent in 1951, four and at least a partial fifth generation. The winter is passed in the pupal cocoon in ground duff around the host tree.

LIFE HISTORY. *Egg stage:* Eggs are deposited naked in masses on the underside of the leaf. They are pale greenish in color, measuring about 1 mm. in length and 0.5 mm. in width. There is a slight increase in size prior

[1] Order Hymenoptera, Family Tenthredinidae, Tribe Nematini. Larvae and adults identified by B. D. Burks.

[2] Published with the approval of the Director of the Arkansas Agricultural Experiment Station. The assistance of Dr. W. J. Baerg is gratefully acknowledged.

to hatching. More than one egg mass may be deposited on a leaf. Nine newly deposited masses having a total of 781 eggs were identified with tags and observed for hatching data in early September, 1950. The number of eggs per mass ranged from 55 to 95, averaging 81.25. On the basis of the eggs in these nine masses, the egg stage lasts from 1 to 4 days, averaging about 2.2 days.

Larval stages: On the host tree the larvae from an egg mass hatched and passed through each of the first two (and sometimes the third) molts en masse. Following the third molt overlapping of instars occurred, as did also larval dispersal, making precise observations difficult. Up to the fourth instar the larvae are a pale yellowish-greenish in color with small dark spots barely noticeable. In the fourth instar the ground color becomes a darker green. A definite pattern of black spots, increasingly prominent with maturity, appears on the dorsum and laterally.

Larval development is fairly rapid under favorable weather conditions. The first and third instars may be as short as one day. The maximum length of individual instars ranged from three days for the third to six days for the fifth. The shortest average period of time between molts was 2.63 days in the third instar, ranging to 3.26 days for the fifth instar. The average time from egg through the fifth instar was 14.87 days; through the sixth instar, 17.87 days. The pupal period varied from 10 to 22 days, averaging 14.3 days (Table 1).

TABLE 1. Duration of larval stages by instars of *Nematus salicis-odoratus* Dyar, Fayetteville, Arkansas 1951 and 1950

	INSTAR						
	1	2	3	4	5	6	Pupal Period
No. larvae reared	100	54	38	18	15	10	19
Av. no. days in each stage	3.25	3.07	2.63	2.66	3.26	3.0	14.3
Range—in days	1-4	3-4	1-3	2-3	2-6	—	10-22

Nearly half of the larvae entered the soil at the end of the fifth instar, the remainder molting to the sixth to complete development. Contrary to previous descriptions of the pupal shell as being black (Dyar, 1894), it was, in all instances observed during this study, a rather flimsily built, dark tan to brown colored cocoon.

SUMMARY

A sawfly, *Nematus salicis-odoratus,* attacking willow, *Salix babylonica,* appeared in northwest Arkansas during 1950 and 1951. The known range of this insect was extended and observations were made on its life and seasonal history. There may be as many as four and a partial fifth, generations in this area. The life cycle ranges from 19 to 42 days, averaging 31.37. No parasitic insects were reared from larval forms during this study. Following 1951, infestations disappeared and no further records of its occurrence have been obtained.

LITERATURE

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DESCRIPTION OF A NEW *PERIGLISCHRUS* FROM A BAT, *MORMOOPS MEGALOPHYLLA SENICULA* REHN, TOGETHER WITH A KEY TO THE SPECIES OF *PERIGLISCHRUS* (Acarina, Spinturnicidae)[1]

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Radford (1950) placed six genera in the family Spinturnicidae: *Spinturnix* Heyden, *Periglischrus* Kolenati, *Meristaspis* Kolenati, *Ancystropus* Kolenati, *Tympanospinctus* Berlese and *Rhinoecius* Cooreman. However, Hirst (1923), Vitzthum (1943) and Zumpt (1951) regarded *Meristaspis* Kolenati as a subgenus of *Ancystropus*.

Vitzthum (1943) separated the genus *Spinturnix* from the genus *Ancystropus* Kolenati by the size and shape of the jugular plate. All species with a small rounded plate, which he designated as a tritosternum, were placed in the genus *Spinturnix* and those with a large rectangular plate, which he designated as a jugular plate, were placed in the genus *Ancystropus*.

Zumpt (1951) compared the species of *Spinturnix* and *Ancystropus* and found all transitions between the small rounded plate and the large rectangular plate. He therefore united the genus *Ancystropus* with *Spinturnix* and regarded those species with a large jugular plate as primitive forms and those with small rounded plates, or in which it is wanting, as more advanced.

Since *Rhinoecius* belongs to the family Rhinonyssidae and according to Vitzthum, *Tympanospinctus* probably does not belong to *Spinturnicidae*, Zumpt retains only the two genera, *Spinturnix* Heyden and *Periglischrus* Kolenati for the family Spinturnicidae. The following is Zumpt's key to the genera:

1 (2) Peritremes bent from the dorsal side to the venter. Opisthosoma not strikingly expanded in the engorged female. Jugular plate mostly distinct, rarely totally reduced .....*Spinturnix* Heyden 1826
(=*Ancystropus* Kolenati 1857)
(=*Meristapis* Kolenati 1857)

2 (1) Peritremes confined to the dorsum. Opisthosoma strongly expanded in the engorged female. Jugular plate always wanting.
.....*Periglischrus* Kolenati 1857

In 1857 Kolenati erected the genus *Periglischrus* with *Periglischrus caligus* as the type species. At the same time he also described four more species, *P. interruptus, P. hipposiderus, P. asema* and *P. glutinimargo*. The specimens of *P. hipposiderus, P. asema, P. caligus* and *P. glutinimargo* are not available for study and the localities and hosts are not known except for the host of *P. glutinimargo* which was given as *Rhinolophus clivosus*.

Periglischrus interruptus was redescribed by Hirst in 1927. It was collected by him from *Rhinolophus euryale* at Corsica. Kolenati gave *Rhinolophus blasii* as the host without any location in his original work.

[1] This investigation was supported, in part, by research grant E 1246 from the National Institute of Allergy and Infectious Diseases of the National Institutes of Health, Public Health Service.

In order to separate the species of *Periglischrus* known to me the following key is presented, based on the females:

KEY TO THE SPECIES

1. Sternal plate with setae ..... *P. strandtmanni* n. sp. (Fig. 1, Plate I)
   Sternal plate without setae 2
2. Ventral area of opisthosoma without setae ..... *P. africanus* Zumpt (Fig. 3, Plate IV)
   Ventral area of opisthosoma with setae 3
3. Opisthosoma with heavily sclerotized areas ..... *P. vargasi* Hoffman M. (Fig. 2, Plate IV)
   Opisthosoma without heavily sclerotized areas 4
4. Three pairs of setae present in area lateral to sternal plate 5
   No setae present in area lateral to sternal plate ..... *P. interruptus* Kolenati Fig. 4, Plate IV)
5. Sternal plate separated from the genito-ventral plate by a distance of at least one half the length of the genito-ventral plate, ventral opisthosomal area with three pairs of setae ..... *P. jheringi* Oudemans (Fig. 5, Plate IV)
   Sternal plate not separated from genito-ventral plate by this distance. Ventral opisthosomal area with seven pairs of setae ..... *P. meridensis* Hirst (Fig. 1, Plate IV)

Periglischrus strandtmanni n. sp.

FEMALE (Fig. 1, Plate I). Body length excluding gnathosoma 895μ and body width, just posterior to coxae IV, 567μ.

Venter: Sternal plate reduced, 117μ long and 64μ wide. Anterior margin slightly convex; lateral and posterior margins concave. First pair of sternal setae located on the anterior margin; second and third pairs of sternal setae located on posterior margin. Two pairs of pores on sternal shield. Metasternal setae located about midway between sternal plate and genital opening. (An egg can be seen through the integument, 222μ long and 199μ wide.) Integument between sternal plate and coxae II and III with area of spinelike projections (Fig. 3, Plate I). Genito-ventral plate greatly reduced, bearing paired genital setae on posterior margin.

Three areas of heavy sclerotization present; first just posterior to coxae IV, second midway between coxae IV and posterior end, and third flanking area of anal opening. The most heavily sclerotized plates are midway to the posterior end. Posterior to genito-ventral plate and anterior to heavily sclerotized plates are three pairs of setae. Posterior to these setae are six pairs of tri-pointed setae (Fig. 2, Plate I).

Dorsum (Fig. 4, Plate I): Dorsal plate reduced, consisting of two weakly sclerotized plates. Large anterior plate with six pairs of small circular areas situated near the lateral margins. Small posterior plate with one pair of small circular areas. Stigma and peritreme dorsal. Stigma situated at a level between coxae III and IV. Peritreme running anteriorly to a point even with anterior margin of coxae III, then converging slightly and running to a point even with anterior margin of coxae II. On dorsal surface between dorsal plates and peritreme in podosomal area are five pairs

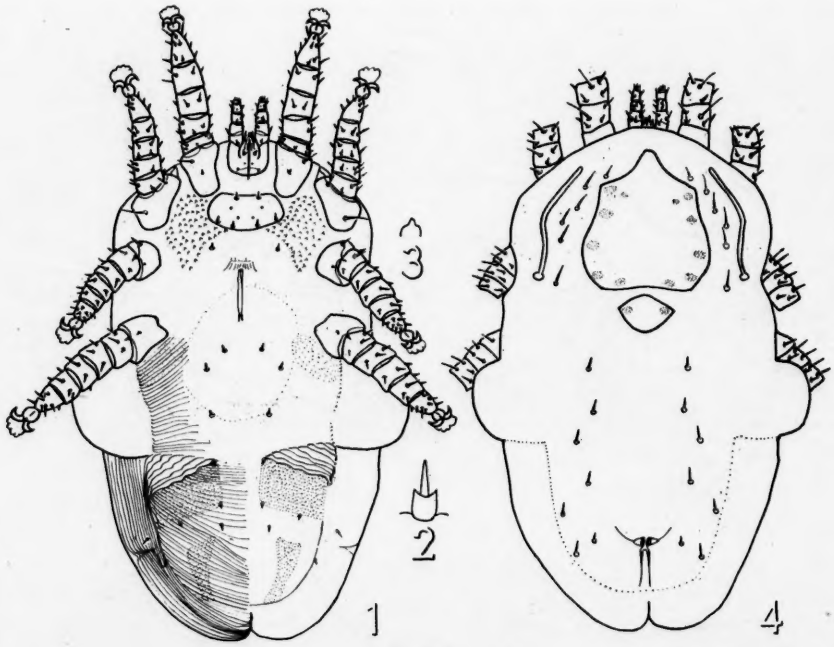

PLATE I

Periglischrus strandtmanni n. sp. Female: fig. 1, venter; fig. 2, ventral tri-pointed seta; fig. 3, scalelike projection; fig. 4, dorsum.

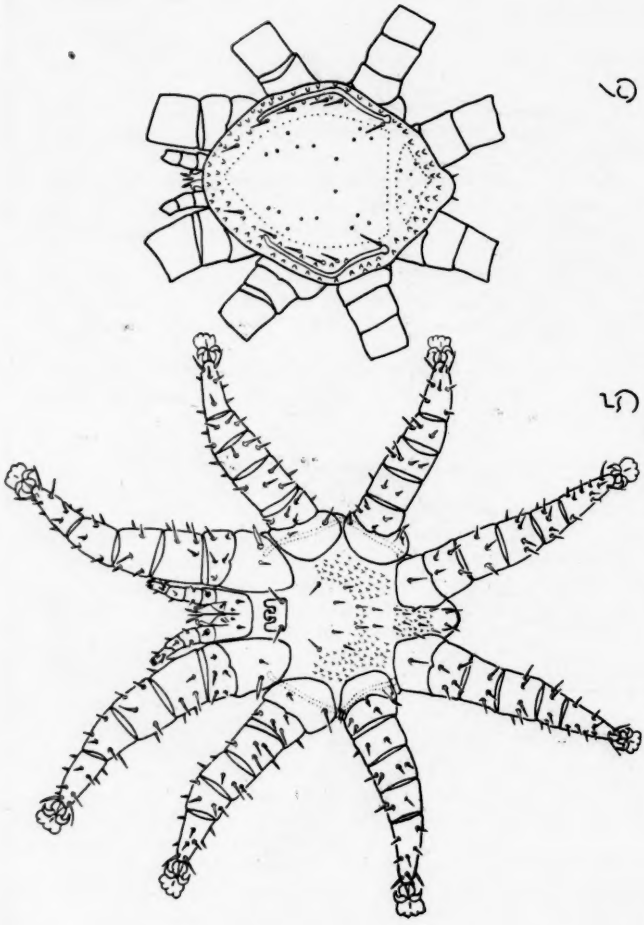

PLATE II

Periglischrus strandmanni n. sp. Male: fig. 5, venter; fig. 6, dorsum.

of dorsal setae and at anterior margin of anterior dorsal plate, one pair of setae. In opisthosomal region are seven pairs of setae. Anal opening dorsal, 128μ from posterior margin, situated in slight depression, shielded by "Y"-shaped anal plate which has two long posterior setae.

Legs: Short and stout. Chaetotaxy of ventral sides of legs as figured. Claws well developed. Coxa I with two setae; coxa II has two setae and an anterior spurlike spine; coxa III has two setae and coxa IV, one.

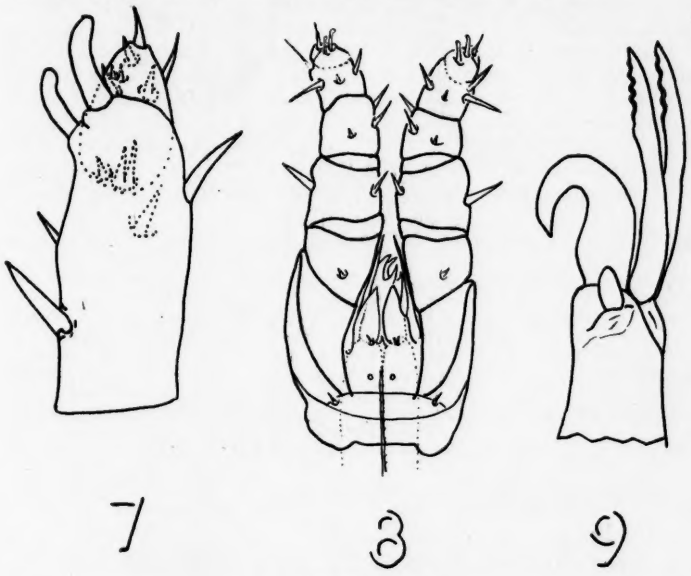

PLATE III

Periglischrus strandtmanni n. sp. fig. 7, tibial and tarsal segment of palp (male); fig. 8, gnathosoma (female); fig. 9, chela (male).

Gnathosoma (Fig. 8, Plate III): Chelicera weakly chelate. Palp of usual form; 128μ long from base of palpal coxa to tip of tarsus. One pair of setae at base of gnathosoma, one pair of setae and one pair of pores on hypostome. Forked seta on palpal tarsus with two tines (Fig. 7, Plate III).

MALE (Fig. 5, Plate II). Body length excluding gnathosoma, 333μ, and body width 310μ. Chela modified as figured (Fig. 9, Plate III).

Venter: Sternal plate and chaetotaxy as figured. Opisthosoma not extended posteriorly as in female.

Dorsum: (Fig. 6, Plate II). Dorsum covered by two weakly sclerotized plates. Anterior plate originates even with anterior margins of coxae I and ends truncate even with spiracle openings. No setae present on this plate; however, nine pairs of small pores present. Posterior plate very small, covering small area on posterior end of dorsum. Three pairs of small pores present. On integument between dorsal plates and lateral margin of the body, skin striae broken by spinelike or scalelike projections.

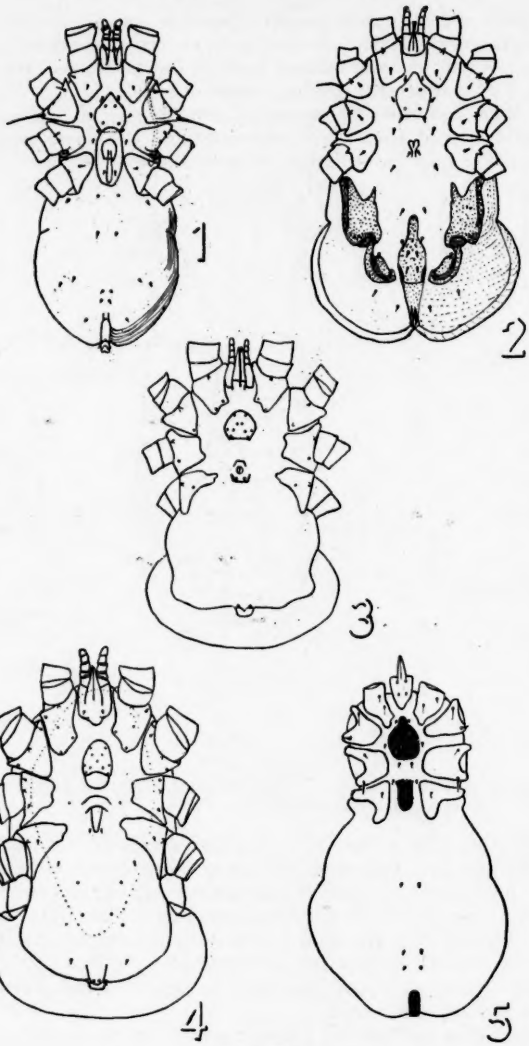

PLATE IV

Periglischrus species: fig. 1, *P. meridensis* Hirst (redrawn from Hirst, 1927); fig. 2, *P. vargasi* Hoffman M (redrawn from Hoffman M, 1944); fig. 3, *P. africanus* Zumpt (redrawn from Zumpt, 1950); fig. 4, *P. interruptus* Kolenati (redrawn from Hirst, 1923); fig. 5, *P. jheringi* Oudemans (redrawn from Oudemans, 1903).

Six dorsal spines present as figured. Peritreme dorsal as in female, originating in an area even with posterior margin of coxae III and extending to an area slightly past posterior margin of coxae I.

Host. Mormoops megalophylla senicula Rehn. (Bat).

Location. Frio Cave, Uvalde County, Texas, 22 January, 1956.

Material. Holotype female and allotype male deposited in the U.S. National Museum.

Remarks. One male and one female *Perisglischrus strandtmanni* were collected by D. K. Jameson at Frio Cave, Uvalde County, Texas, January 22, 1956. Mr. Jameson was collecting material for his master's thesis, "A Survey on Five Species of Bats and their Parasites" (1956). This mite differs from other *Periglischrus* in that the sternal setae are located on the sternal plate and areas of spinelike or scalelike projections are present. This mite has been named after Dr. R. W. Strandtmann, Texas Technological College, one of the outstanding mite specialists in the United States, whose suggestions and criticisms on this paper were deeply appreciated.

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DESCRIPTIONS OF TWO SPECIES OF THE GENUS *BRACHYMETRA*[1] (Gerridae, Hemiptera)

HERBERT B. HUNGERFORD and RYUICHI MATSUDA

Recently the authors had an opportunity to examine the type specimens of *Brachymetra kleopatra* Kirkaldy and found that the species identified as *Brachymetra kleopatra* Kirkaldy by Shaw (1931) is quite distinct from it. Therefore, we are giving a redescription of *Brachymetra kleopatra* Kirkaldy based upon the type specimens from the Museum of Zoology of the University of Torino, Italy, which were collected in Ecuador and additional specimens from northern Peru in the University of Kansas collection. We are also describing *Brachymetra kleopatra* of Shaw as new.

Brachymetra kleopatra Kirkaldy
(Pl. 1, figs. D-F; Pl. 2, figs. A-E)

Brachymetra kleopatra Kirkaldy, Bolletino dei Musei di Zoologia ed Anatomia Comparata, della R. Universita di Torino, Vol. XIV, No. 350, 1899, p. 3.

[1] Contribution No. 932 from the Department of Entomology, University of Kansas.

Brachymetra mera Harris and Drake, Proc. Ent. Soc. Washington, Vol. 47, p. 211. 1945 (New Synonym.)

COLORATION. Reddish brown. Eyes grayish blue to dark reddish brown. Tubercles on basal angles of head darker. Meso- and meta-thoracic acetabula with a mass of silvery pubescence above coxae. Body beneath paler. Rostrum with last segment black. Hemelytra reddish brown, paler apically.

STRUCTURAL CHARACTERISTICS. *Winged forms:* Head a little less than twice as wide across eyes as long on longitudinal axis (54 : 30), a little less than three-fourths as wide as pronotum at humeral angles (54 : 76). Proportional lengths of antennal segments in type specimens are 52 : 27.5 : 38 : 31 in male and 50 : 25 : 37 : 29 in female; third segment with distinct accessory segment of Lundblad; fourth segment simply narrowed at base. Eyes with inner margin feebly sinuated. Vertex with distinct tubercles at basal angles, about as wide at base as space between antenniferous tubercles.

Pronotum elongate subpentagonal in shape, less than twice as long as wide (120 : 76); four times as long as head (120 : 30), nearly straightly narrowed both anteriorly and posteriorly from humeral angles, upper surface with humeri slightly elevated, highest across humeri. Foreleg with femur a little longer than tibia. Hind femur longer than length of body (85 : 80) in female. Metasternum, anterior to suture across ventral omphalium in middle, over three times as long as area posterior to omphalium. Spiracle on second ventral abdominal segment placed close to posterior margin; spiracles on third to seventh segments placed slightly closer to anterior margin than to posterior margin of each segment.

Wingless forms: Pronotum over three times as long as head (103 : 29), slightly longitudinally medianly depressed on anterior lobe which has its lateral margins concave posteriorly; posterior lobe with lateral margin slightly dilated at middle, then narrowed posteriorly, apex broadly rounded. Mesonotum inclined laterally, gently rounded on lateral margin, posterior margin of mesonotum obliterated, but its mesal ending is traceable at a little behind the middle of lateral margin of pronotum. Metanotum with longitudinal suture behind apex of pronotum obscure, about two-thirds as long as first segment in the middle, posterior margin of first tergal segment broadly concave and distinct. Abdomen subparallel-sided in basal six segments and broadly rounded on lateral margin of seventh segment in male, evenly and gradually narrowed apically in female. Proportion of total length of body to intermediate leg from coxa to apex of femur is 178 : 192 or 1 : 1.08 in male, and 173 : 182 or 1 : 1.05 in female; the same in hind leg is 178 : 208 or 1 : 1.17 in male, and 173 : 196 or 1 : 1.13 in female. Proportional length of femur to tibia in intermediate leg is 182 : 184 or 1 : 1.01 in male, and 166 : 172 or 1 : 1.03 in female, the same in hind leg is 203 : 110 or 1 : 0.58 in male, and 188 : 103 or 1 : 0.55 in female.

MALE. Seventh ventral abdominal segment with basal margin broadly concave. Eighth abdominal segment with lateral margins rounded; ventral side of same segment with posterior margin at middle slightly concave, about three-fourths as long as seventh segment, also a little shorter than ninth ventral abdominal segment. Ninth ventral segment with apical mar-

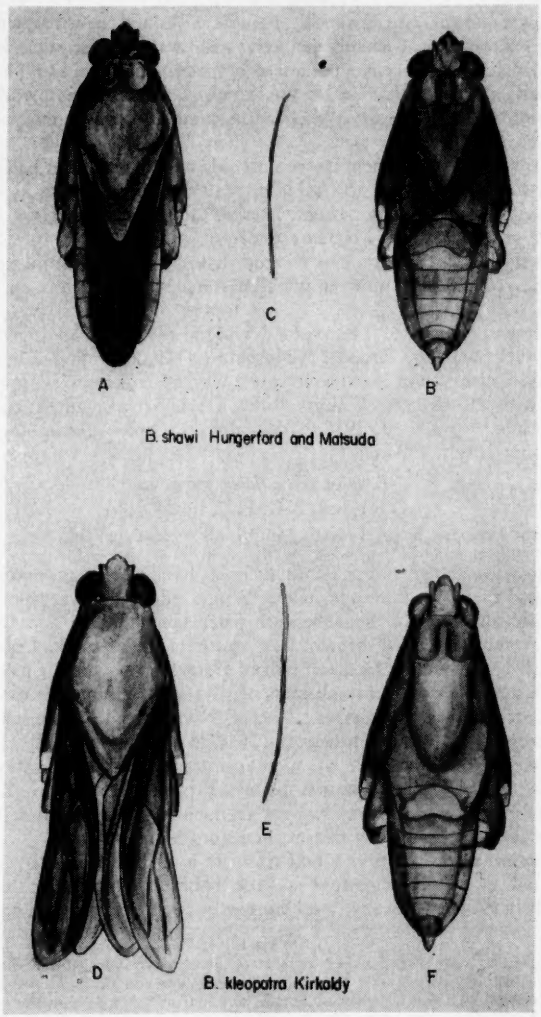


PLATE I

A. Winged male of *Brachymetra shawi* Hungerford and Matsuda (from Peru). B. Wingless female of *B. shawi* Hungerford and Matsuda (from Peru). C. Antenna of the male *B. shawi* Hungerford and Matsuda (from Peru). D. Winged male of *Brachymetra kleopatra* Kirkaldy (type specimen). E. Antenna of winged male of *B. kleopatra* Kirkaldy (type specimen). F. Wingless female of *B. kleopatra* Kirkaldy (from Brazil).

gin feebly emarginated at middle. Paramere simply curved upwards and tapering apically, apex acutely pointed, with a distinct straight basal elevation which is higher than paramere proper in lateral view. Theca with a subtriangular sclerotized area. Aedeagus short, apex simply narrowed and rounded, ventral margin with a conspicuous boot-shaped process directed ventrad.

FEMALE. Seventh segment on ventral side about one and a half times as long as sixth segment in the middle, posterior margin broadly concave. Eighth segment densely pubescent, lateral margin nearly straight or feebly rounded, posterior margin feebly concave or straight.

Length of body: 9.2 mm. in winged male (Type), 9.0 mm. in winged female (Type); 8.0-8.6 mm. in wingless females, 8.3-8.4 mm. in wingless males.

Specimens examined: The types, 1 winged male and 1 winged female, from Valle Santiago, Ecuador (Museum of Zoology and Comparative Anatomy, University of Torino, Italy); 3 winged females, 6 wingless males and 19 wingless females, Vicinity Rioja, Dept. San Martin, Peru, Jungle, 900 m., Sept. 9 to Oct. 3, 1936, F. Woytowski. (Snow Entomological Museum, University of Kansas.)

Brachymetra shawi sp. nov.
(Pl. 1, figs. A-C; Pl. 2, figs. F-J)

Brachymetra kleopatra, Shaw, University of Kansas Science Bulletin, 21(9):226. 1933. (misidentification)

COLORATION. Head except for tubercles at basal angles, pronotum, mesonotum, and metanotum orange yellow. Wings reddish brown, paler apically, veins paler and distinct. Body beneath paler. Eyes grayish blue to reddish brown. Antennae reddish brown. Last rostral segment black. Legs fuscous to reddish brown except for basal half of front femur which is paler. Meso- and meta-acetabula with a small mass of silvery pubescence forming a spot.

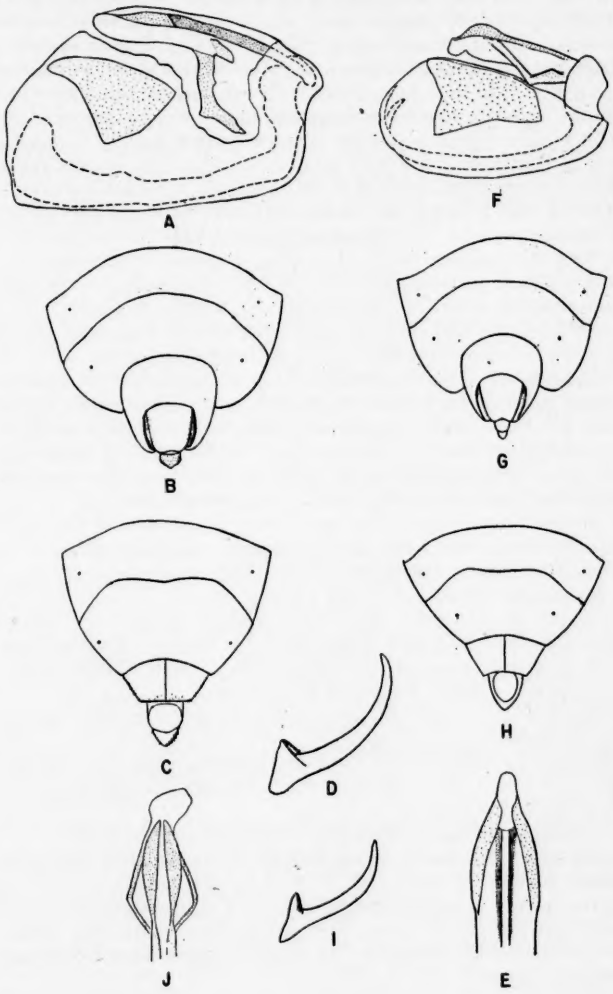
STRUCTURAL CHARACTERISTICS. *Winged forms:* Head a little longer than wide across antenniferous tubercles (26 : 23), about one-half as long as wide across eyes (26 : 54), lateral margins sinuate behind antenniferous tubercles; tubercles at basal angles distinct. Proportional lengths of antennal segments are 40 : 25 : 32 : 29. First segment slightly arched at base, the rest straight, third one with distinct accessory segment.

Pronotum over four and a half times as long as head (122 : 26), subpentagonal in shape, widest at a little behind anterior one-third, then straightly narrowed apically, apex narrowly rounded, wider than greatest

PLATE II

A. Lateral view of genital chamber in male of *Brachymetra kleopatra* Kirkaldy (from Peru). B. Ventral view of male terminal abdominal segments of *B. kleopatra* Kirkaldy (type specimen). C. Ventral view of female terminal abdominal segments of *B. kleopatra* Kirkaldy (type specimen). D. Lateral view of paramere of *B. kleopatra* Kirkaldy. E. Dorsal view of apical region of aedeagus of *B. kleopatra* Kirkaldy. F. Lateral view of genital chamber in male of *Brachymetra shawi* Hungerford and Matsuda. G. Ventral view of male terminal abdominal segments of *B. shawi* Hungerford and Matsuda. H. Ventral view of female terminal abdominal segments of *B. shawi* Hungerford and Matsuda. I. Lateral view of paramere of *B. shawi* Hungerford and Matsuda. J. Dorsal view of apical region of aedeagus of *B. shawi* Hungerford and Matsuda.

width of head across eyes (72 : 54), shallowly longitudinally depressed in the middle of anterior lobe, forming a pair of low elevations behind eyes, occasionally with a median more or less faint longitudinal stripe behind the depression, humeri narrowly elevated, apical region of posterior lobe level or sometimes with obscure transverse impressions. Hemelytra distinctly extending beyond apex of abdomen. Intermediate femur shorter than total



length of body (68 : 72). Hind femur a little longer than length of body (82 : 75).

Wingless form: Pronotum a little over three times as long as head (95 : 30), lateral margin behind propleural region rounded, apex narrowly rounded; upper surface of anterior lobe with a depression behind posterior margin of head, occasionally with a more or less faint fuscous longitudinal stripe behind the depression, disc of posterior lobe inclined laterally, apex narrowly rounded. Mesonotum gradually widened posteriorly, lateral margin feebly rounded, posterior margin of mesonotum indistinct in most cases. Metanotum with median longitudinal suture behind apex of pronotum indistinct. Abdomen in male rounded on lateral margin and widest in third to fourth segments, suboval in shape and rather strongly narrowed posteriorly in female. Tergal plate with anterior margin slightly rounded. First dorsal abdominal segment with posterior margin broadly emarginated in middle. Proportion of width across mesacetabula to total length of body is 57 : 143 or 0.40 : 1.00 in both sexes. Proportion of total length of body to intermediate leg from coxa to apex of femur is 143 : 148 or 1 : 1.03 in female and 143 : 160 or 1.00 : 1.12 in male; the same in hind leg: 143 : 180 or 1.00 : 1.27 in male and 143 : 160 or 1.00 : 1.12 in female. Proportional length of femur to tibia in intermediate leg is 152 : 152 or 1.00 : 1.00 in male, 152 : 153 or 1.00 : 1.01 in female; the same in hing leg is 152 : 90 or 1.00 : 0.59 in male, 150 : 85 or 1.00 : 0.57 in female.

MALE. Seventh ventral abdominal segment with basal margin sinuate at sides, posterior angle broadly rounded, longer than eighth segment at middle (13 : 10). Eighth segment on ventral side strongly concave on posterior margin at middle, lateral margin broadly rounded. Ninth segment with apical margin distinctly notched at middle. Paramere simply arched upward and tapering apically, apex acutely pointed, basal elevation strong and oblique, much higher than upper margin of paramere proper. Theca with sclerotized area large and transversely subquadrangular in shape. Aedeagus with apical region somewhat swollen and rounded apically, without conspicuous process on ventral margin.

FEMALE. Seventh ventral abdominal segment a little less than twice as long as sixth segment, apical margin broadly concave. Eighth segment with lateral margin straight, apical margin concave. Ninth segment with lateral margin nearly straight, apical margin concave.

Length of body: 8.30-8.66 mm. in both winged sexes; 7.51 mm. in both wingless sexes.

Holotype: 1 winged male, Rio Beni Cachuela, Esperanza, Bolivia, Sept., 1937, A. M. Olalla. Allotopotype: 1 winged female. Paratopotypes: 7 winged males, 13 wingless females.

Additional specimens examined: 8 winged and 2 wingless males, 17 winged and 1 wingless females, Rio Amazonas (Norte) Region de Itacoatiara, Brazil, Jan.-Apr., 1936, A. M. Olalla; 1 winged female, Cayenne, French Guiana; 1 winged female, near New Amsterdam, British Guiana, July 30, 1923, F. X. Williams; 1 winged female, Brownsberg Creek, Surinam, Sept. 19, 1938, Geijsker. (All in Snow Entomological Museum, University of Kansas.)

This new species resembles *B. kleopatra* Kirkaldy, but may be distinguished from it by the following points: 1. Wings much darker than pronotum in *B. shawi,* not in *B. kleopatra.* 2. Different proportional length of antennal segments, third segment relatively longer in *B. kleopatra.* 3. Pronotum in winged forms widest distinctly in front of the middle in *B. shawi* and widest at middle in *B. kleopatra.* Pronotum in wingless forms much wider in *B. shawi.* 4. Posterolateral angle of seventh abdominal segment broadly rounded in male in *B. shawi,* not so in *B. kleopatra.* 5. Basal elevation of paramere is relatively higher in *B. shawi* than in *B. kleopatra.* 6. The shapes of sclerotized areas on theca and aedeagus are widely different in the two species.

OBSERVATIONS ON THE WHEAT CURL MITE, *ACERIA TULIPAE* (K.), (ACARINA, ERIOPHYIDAE) ON WHEAT AND SORGHUM SPROUTED UNDER RIPENING WHEAT[1,2]

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Observations in the field during 1953 and 1954 indicated that volunteer wheat which emerged through wheat straw seemed to have larger populations of the wheat curl mite than wheat starting on clean cultivated ground. The work recorded herein was designed primarily to investigate this observation further. Additional objectives were to observe the duration of mass movements of mites from ripening grain and to determine how long the mites, following migration, would remain on young sorghum plants compared with wheat seedlings when both were planted in the immediate vicinity of the source of infestation.

PROCEDURE

A uniform stand of Pawnee wheat which was heading was used as a source of mite infestation. It had been planted in October, 1954, with rows spaced one foot apart. At the time of the first four experimental wheat and sorghum plantings, unripe wheat heads contained heavy mite populations.

Slykhuis (1955) stated that "mature [wheat] plants are also not suitable hosts for *A. tulipae*" in Alberta. Slykhuis's statement is true regarding ripe, dry plants. However, in Kansas, heavy populations develop in the green heads and remain there up to the stage when the heads are brown but contain kernels in the soft dough stage. This was first reported by Kantack and Knutson (1954).

New plantings of Pawnee wheat and Westland sorghum were made

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between rows of the ripening wheat used as a source of mites. In one case, the rows of the ripening wheat were cut and removed before wheat and sorghum were planted, leaving only a stubble four inches high to simulate normal harvesting. In the other case, the ripening wheat was not cut but was trampled over the new plantings to simulate lodging. Favorable moisture conditions resulted in rapid sprouting of wheat and sorghum plantings in five to nine days. These new simulated volunteer plantings were repeated at approximately ten-day intervals and were spaced at least eight feet apart, leaving the maturing wheat standing in the intervening spaces. The seed used was 1951 Pawnee wheat and 1953 Westland sorghum. Both had been under continuous naphthalene fumigation, eliminating any chance of viable eriophyid mites or eggs being introduced on the seed.

Samples of the seedling wheat and sorghum plants were taken at seven- to ten-day intervals, wrapped separately by plantings in aluminum foil, and kept under refrigeration until examined. Since past experience by the writer had shown that the percentage of samples infested was a more accurate measure of mite spread than the actual number of mites present, the former system was followed.

Results (Table 1) showed that wheat seedlings emerging while eriophyids were still numerous on nearby green wheat heads were quickly and heavily infested. As the wheat ripened and fewer green heads were present, the percentage of infestation in the new wheat plantings decreased. At the time of the last planting, July 4, no mites were found on the fully ripened heads of nearby wheat; likewise, no mites were found on seedlings of this planting when they were sampled July 14.

No significant differences between the levels of mite infestation on the stubble and the lodged plantings were found. Chi squares on wheat and sorghum were 1.60 and 0.19, respectively.

The longest period during which mites remained on sorghum was 26 days after emergence of the sorghum plants from the soil. Eggs were found on only four of 32 mite-infested sorghum plants examined, all of which were in the two-leaf stage of development, suggesting that sorghum was a reproductive host for mites only as a young plant. At the same time, mite eggs were found on most of the wheat plants harboring adult mites.

Wheat and sorghum plants seeded under the artificially lodged wheat emerged earlier and grew faster as a result of more favorable moisture conditions. However, these plants were attacked by grasshoppers, crickets, various seed-eating beetles, and rodents which took shelter under the lodged wheat. Many corn leaf aphids, *Rhopalosiphum maidis* (Fitch.), greenbugs, *Toxoptera graminum* (Rond.), and occasionally apple grain aphids, *Rhopalosiphum fitchii* (Sand.) were also present on the young wheat plants, and contributed toward the death of these plants. Within a month after planting, all the wheat plants between stubble rows had died from lack of moisture, while all those under lodged wheat were eventually destroyed by insects and rodents. Although many sorghum plants were similarly destroyed, some plants survived and reached maturity.

Under these experimental conditions, wheat seedlings emerging through

TABLE 1. Wheat and sorghum seedlings infested with *A. tulipae*, when emerging between stubble and under lodged wheat, Manhattan, Kansas, 1955

Planting date	Condition of wheat plants used as mite source at planting date	Planting condition	Wheat						Sorghum					
			5-10 days		15-20 days		25-35 days		5-10 days		15-20 days		25-35 days	
			Plants no.	Infest. %	Plants no.	Infest. %	Plants no.	Infest. %	Plants no.	Infest. %	Plants no.	Infest. %	Plants no.	Infest. %
May 24	Most of heads green; early soft dough stage. Heavy mite infestation.	Between stubble	10	60	20	100	....	....	....	....	....	....	....	....
		Under lodged	10	90	15	85	....	....	....	....	....	....	....	....
June 2	90% heads brown; 70% kernels soft dough stage; 30% hard dough stage. Heavy mite infestation.	Between stubble	20	95	10	100	....	....	5	100	9	67	14	7
		Under lodged	20	85	10	100	....	....	5	80	10	50	14	14
June 12	95% heads brown; 90% kernels in late soft to early hard dough stage. Heavy mite infestation.	Between stubble	Not emerged		1	100	15	20	Not emerged		14	7	9	44
		Under lodged	20	40	18	11	3	33	3	33	8	0	6	33
June 21	80%-90% kernels ripe; no green heads. Heavy mite infestation on 10%-20% still in early hard dough stage.	Between stubble	18	6	20	20	....	....	8	0	8	0	....	....
		Under lodged	20	10	22	18	....	....	....	....	5	20	....	....
July 4	All grain ripe; no mites found on kernels.	Between stubble	15	0	....	....	....	....	10	0	12	0	....	....
		Under lodged	17	0	....	....	....	....	10	0	....	....	....	....

mite-infested, lodged wheat and wheat emerging in open stubble ground had high levels of mite infestation. This may have resulted from a "saturation" effect, since great numbers of mites were apparently blown to the planted seedlings from the ripening wheat nearby. However, the lodged wheat held more moisture in the ground, which caused earlier emergence and better growth of the artificial volunteer. This extra moisture under lodged wheat may be a critical factor in the survival of volunteer during dry periods, which occur frequently in Kansas during the summer.

Mites were found on newly sprouted seedlings only as long as they were present on the maturing wheat heads, thus indicating that the movement of mites terminated promptly after their disappearance from the ripened wheat heads. It must be pointed out, however, that at the time of the last planting (July 4) daily temperatures often approximated 100° F. and mite populations declined on all wheat plants examined from the field. Staples and Allington (1956) also reported a sudden, unexplained decrease in mite populations on volunteer wheat during the summer.

The 26-day period (June 2 to July 6) during which mites survived on sorghum plants would not be sufficient to carry them over to the new wheat crop, but might provide a timely bridge to early volunteer wheat or other suitable hosts.

CONCLUSIONS AND SUMMARY

Wheat and sorghum were planted near normal wheat harvest time under artificially lodged wheat and in stubble, in a field heavily infested with *Aceria tulipae* (K.). Periodic counts on the resulting seedlings showed that:

1. Large numbers of eriophid mites left the ripening grain and infested the seedlings equally under lodged and stubble conditions.
2. Mites were observed on the newly emerged seedlings only as long as they were present on the standing grain. Mite movement apparently ceased abruptly when the last heads ripened.
3. Mites were found on sorghum seedlings a maximum of 26 days after emergence. Eggs were present on only four of 32 infested sorghum plants examined, all of which were in the two-leaf stage, suggesting that this host may not be favorable for continuous mite reproduction in the field.
4. The fact that seedling plants emerged earlier and grew better under lodged wheat as a result of more favorable moisture conditions may partially account for the more frequent occurrence of mites on volunteer wheat which emerges through a heavy layer of wheat straw in Kansas wheat fields.

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DISTRIBUTION OF THE GENUS *LACCOPHILUS* IN SOUTH DAKOTA (Coleoptera: Dytiscidae)[1]

J. R. ZIMMERMAN AND H. C. SEVERIN

Examination of specimens of *Laccophilus* representing collections from 46 of the 67 counties of South Dakota shows that four, and possibly five, species of this genus occur in the state. *Laccophilus maculosus* Say, *L. proximus* Say, *L. decipiens* Leconte, and *L. terminalis* Sharp definitely occur; and *L. fasciatus* Aube may be found in the eastern counties. South Dakota is particularly interesting in that it covers the eastern limit of *decipiens,* the northern limit of *terminalis,* the western limits of both *proximus* and *maculosus,* and, possibly, the northwestern limit of the range of *fasciatus.*

The collections studied seem to represent a reasonable sample of the populations of the various species. Some of the lots contain only a few specimens; but, on the other hand, as many as 434 specimens of the same species are represented in one lot (*maculosus* in Mellette Co.). A total of 1,685 specimens were examined.

Determinations were verified by comparison of the male genitalia (the aedeagus in particular) with specimens from other parts of the United States, Mexico, and Canada. Identification was considered positive except in a few instances discussed below. *L. decipiens* was checked against specimens from British Columbia and was compared with *L. shermani* Leech from Arizona; *maculosus* against specimens from Indiana; *proximus* against specimens from Indiana, Texas and Florida; and *terminalis* against specimens from Mexico and Texas. A single male specimen of what may be *fasciatus* was damaged so that positive identification is not possible. Several individual females cannot be positively placed as either *terminalis* or *fasciatus* since the elytral pattern of these two species is so similar.

Laccophilus decipiens has been recorded by Leech (1948), Hatch (1953), and others, along the west coast from Lower California to Oregon and Washington. The extent of penetration inland, however, is not too well known. The western counties of South Dakota appear to be near the eastern limit. Furthermore, *maculosus,* a distinct but similar species, clearly increases sharply in numbers and in points of occurrence immediately east of the range of *decipiens.* The latter was not found east of Haakon and Jackson counties.

Laccophilus maculosus is the most abundant species of the genus in South Dakota, representing approximately 80 per cent of the specimens examined. It is represented in collections from all parts of the state but decreases rapidly in numbers where its range overlaps that of *decipiens.* It was not possible to show intergradation between the two, and they seem

[1] Contribution No. 612 from the Zoological Laboratories of Indiana University, and No. 348 from the Agricultural Experiment Station of South Dakota State College.

to remain clearly distinct in the areas of overlap. One or two specimens, females unfortunately, might possibly represent hybrids. It seems plausible to conclude that these two forms occupy very similar ecological niches, but in different parts of the continent. The range of *maculosus* extends north into Canada, east to the Atlantic Coast, and south to northern Georgia and Alabama.

The distribution of *Laccophilus proximus* is not so clearly defined, but it is possible to make some generalizations. Young (1954) gives the range as southern Canada to Florida in this country, and into Mexico and the Antilles. He suggests that *proximus* represents a "Rassenkreis"; but we can find no striking differences among specimens from such widely separated localities as Florida, Texas, and South Dakota. We have specimens of *proximus* from the extreme northern part of South Dakota, but only in the eastern counties. A western limit is apparent in Haakon and Jackson counties. These two counties were the only ones in which four species were found. As might be expected, the largest numbers of *proximus* are from the southern and eastern counties. In Brookings County, however, where the most intensive collecting was done, only two or three specimens were taken. In the Missouri River valley area *proximus* was found in largest numbers and in several instances was the only *Laccophilus* found.

The range of *Laccophilus terminalis* is not clearly indicated in the literature. In South Dakota it occurs in a roughly triangular area bounded by the Cheyenne and Missouri Rivers and the southern border of the state. In the southeastern corner of the state, however, and Brookings County, several specimens were taken which cannot be positively placed as either *terminalis* or *fasciatus*. Subsequent examination of material from Iowa strongly indicates that these are *fasciatus*. The general vegetation in the southeast is different from that found in most of the rest of the state, and this very easily could be the case.

The material used in the preparation of this publication was collected chiefly by the junior author, but a small amount was taken by G. B. Spawn or with his assistance. The bulk of the material was collected from the waters of the state, but an occasional specimen was taken in light traps or from the windows of lighted store buildings.

A sturdy insect water net or a small-meshed minnow net was used in capturing the beetles in the water. The plant materials taken in the nets were dumped upon a large, shallow, white porcelain pan and then a small amount was transferred to a second pan, where it was scattered in a thin layer. As the beetles became active they were captured by hand and killed in a cyanide jar. Sunshine on the plant materials shortened the time interval before the beetles became active.

Lakes, small ponds and slowly running rivers or smaller streams were worked for the beetles. Most of the lakes were freshwater ones but a few contained some salts. The same was true of the ponds. The ponds were of three types: (a) natural ponds formed by water accumulating in natural depressions; (b) gravel pits more or less filled with water; and (c) ponds

Numbers of Specimens of *Laccophilus* Species from Counties in South Dakota

County	*maculosus*	*decipiens*	*proximus*	*terminalis*	*fasciatus*
Roberts	15		6		
Marshall	1				
Grant	1				
Day	74		2		
Deuel	29		2		
Brookings	265		3		1(?)
Kingsbury	1				
Miner	3		4		
Minnehaha	7				
Lincoln	2		6		1(?)
Union	27		4		
Yankton	10		17		2(?)
Brown	1		1		
Beadle	17				
Sanborn	1		2		
Aurora			1		
Hutchinson	3				
Charles Mix	14		2		
Bon Homme	7				
McPherson	6				
Edmunds	2				
Walworth	7				
Hand	1				
Hyde	4				
Buffalo			1		
Lyman	83		82		
Brule	134		109	1	
Tripp	8				
Corson	10				
Dewey	7				
Stanley	4		2		
Haakon	7	2	7	4	
Jones	6				
Jackson	18	1	7	8	
Mellette	434				
Todd	56		1	1	
Bennett	13			2	
Harding	4	8			
Butte		7			
Mead	6				
Lawrence	1	13			
Pennington	16	18			
Custer	8	34			
Shannon	7	6		22	
Fall River		1			
Totals	1320	90	259	38	4

formed by throwing an earthen embankment across one or more water runways.

While the water in all of the lakes and ponds varied in depth with the seasons, there was also considerable variation in depth with the years. Some of the lakes and ponds actually became bone dry during years of low rainfall, and some of the ponds became extremely shallow or entirely dry almost every year.

Whenever a lake had no outlet, the water in it was more or less charged with salts. The concentration of the salts varied from small amounts in some lakes which did not interfere with fish, amphibian and insect life, to heavy concentrations of salts in other lakes which made it impossible for fish, amphibians and most insect life to subsist. The same was true of the waters in ponds, especially those located on the plains west of the Missouri River.

The accompanying table summarizes the numbers of specimens examined. The counties listed are roughly arranged in north-south tiers beginning at the top of the list in the east and moving west down the page.

CONCLUSIONS

There is apparently no intergradation between *decipiens* and *maculosus* in South Dakota, and one replaces the other geographically. The possibility of occasional hybridization cannot, however, be excluded.

If *fasciatus* really occurs in the southeastern corner of the state, then there may be a break between its range and that of *terminalis*.

The penetration of *proximus* only to the middle of the state is probably correlated with the fact that the species is more characteristic of warmer and more humid areas, such as Florida and the Antilles. It probably occurs in marginal habitats in South Dakota.

L. terminalis is characteristic of arid regions in Mexico and Texas, and its range in South Dakota may be confined to the central part which is in the dry plains region.

We wish to thank D. D. Millspaugh and H. E. Jaques for their cooperation in furnishing material from Iowa, and J. B. Wallis for many of the determinations of *decipiens*, and also Frank N. Young for his valuable suggestions.

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